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A new species of the genus *Trimeresurus* Lacépède, 1804 (Reptilia, Squamata, Viperidae) from Southwestern China

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Abstract

Trimeresurus nujiang **sp. nov.**, a new cryptic species of green pit viper is described from southwestern China, based on specimens collected from Gongshan County, Nujiang Lisu Autonomous Prefecture, Yunnan Province, China. Phylogenetic analyses based on DNA sequences of the mitochondrial cyt *b*, ND4, 12S rRNA and 16S rRNA genes supported the new species as an independent lineage (BPP 1.00/BS 100), closely related to *T. stejnegeri* and *T. yunnanensis*. A combination of characters helps delimit the new species from its congeners by: (1) ventrolateral stripe white (above) and dark red (below), present on the first row of dorsal scales in males; ventrolateral stripe faint white present in females; (2) postocular streak absent in both genders; (3) iris golden yellow in both genders; (4) DSR 19 (21/22)–19–15 (13), VEN 164–173, SC 57–68; (5) first upper labial completely separated from the nasal; (6) hemipenes short and spinose, bilobed at 6th/7th plate when unextruded, tips reaching SC 10. The uncorrected genetic distances of mitochondrial gene cyt *b* between the new species and other congeners range from 0.052 (*T. stejnegeri*) to 0.156 (*T. hageni*).

Key Words

Asia, molecular phylogeny, morphology, taxonomy, *Trimeresurus nujiang* sp. nov., *Viridovipera*

Introduction

The Asian green pit vipers (*Trimeresurus* Lacépède, 1804) comprise a species-rich group of venomous snakes that range widely through East, South and Southeast Asia (Gumprecht et al. 2004, Malhotra and Thorpe 2004a; Vogel et al. 2004; Guo et al. 2015; Chen et al. 2021). There are 51 species in the genus *Trimeresurus* recorded to date in Asia (Uetz et al. 2024), among which 14 species are recorded in China, accounting for 27.45% of the total number of known species. Namely *Trimeresurus albolabris* Gray, 1842, *Trimeresurus gracilis* Oshima, 1920, *Trimeresurus stejnegeri* Schmidt, 1925, *Trimeresurus yunnanensis* Schmidt, 1925, *Trimeresurus popeiorum* Smith, 1937, *Trimeresurus medoensis* Zhao, 1977, *Trimeresurus tibetanus* Huang, 1982, *Trimeresurus gumprechti* David, Vogel, Pauwels & Vidal, 2002, *Trimeresurus sichuanensis* (Guo and Wang 2011), *Trimeresurus arunachalensis* Captain, Deepak, Pandit, Bhatt & Athreya, 2019, *Trimeresurus salazar* Mirza, Bhosale, Phansalkar, Sawant, Gowande & Patel, 2020, *Trimeresurus caudornatus* Chen, Ding, Vogel & Shi, 2020, *Trimeresurus guoi* Chen, Shi, Vogel & Ding, 2021, *Trimeresurus lanna* Idiiatullina, Nguyen, Pawangkhanant, Suwannapoom, Chanhome, Mirza, David, Vogel & Poyarkov, 2024. It has been previously recorded that three subgenera with eight species

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inhabit Yunnan Province, China: *T. albolabris*, *T. stejnegeri*, *T. yunnanensis*, *T. popeiorum*, *T. gumprechti*, *T. caudornatus*, *T. guoi*, *T. lanna*, which indicates that this region is a biodiversity hotspot. In recent years, the number of new species in this area has been increasing continuously, which once again emphasizes the underestimation of the biodiversity of local reptiles (e.g., Vogel and Luo 2011; Peng et al. 2014; Chen et al. 2019; Idiiatullina et al. 2024; Malhotra et al. 2025). With the increase of the research efforts in southern China, it is expected that more taxa of the genus *Trimeresurus* will be discovered.

During the surveys in Yunnan province from 2020 to 2024, we collected eleven specimens of a species of the subgenus *Viridovipera* in Gongshan County, Nujiang Lisu Autonomous Prefecture, Yunnan Province, China, which are morphologically similar to *T. yunnanensis*, but can be distinguished by coloration and body measurements. Subsequent molecular analyses revealed that this population shows considerable divergence from other congeners. Herein, we describe this taxon as a new species.

Materials and methods

Sampling

Between 2020 and 2024, eleven individuals of the new species were collected in the wild, including 6 males and 5 females. Samples of muscle and liver were obtained before fixation and fixed in formalin. The specimens were later transferred to 75% ethanol and stored at the Chengdu Institute of Biology (CIB), Chengdu, China and Guangxi Normal University (GXNU), Guilin, China.

Morphologic analysis

The terminology for morphological measurements and descriptions follows Vogel et al. (2004). Measurements of body and tail lengths were taken with a tape ruler to the nearest 1 mm; the other measurements were measured with a slide caliper to the nearest 0.1 mm. The number of ventral scales was counted according to Dowling (1951). Dorsal scale rows were given at one head length behind head, at mid-body and at one head length before vent respectively. Cephalic scales were counted on the shortest line separating the middle of supraoculars. Abbreviations used in the description: Cep = cephalic scale; DSR = dorsal scale row; HL = head length (measured from snout tip to the angle of the jaw); HW = head width (measured at the widest part of the head); IIN = number of scales separating the internasals; IL = infralabial scale; MSR = dorsal scale rows at mid-body; SC = subcaudal scale, SL = supralabial scale; SVL = snout-vent length; TaL = tail length; TL = total length; TaL/TL = ratio of tail length to total length; VEN = ventral scale. Sex was determined by checking for the presence of hemipenes.

Institution acronyms

CAS = California Academy of Sciences, San Francisco, USA; **CIB** = Chengdu Institute of Biology, Chengdu, China; **FMNH** = Field Museum of Natural History, Chicago, USA; **GXNU** = Guangxi Normal University, Guilin, China; **IEBR** = Institute of Ecology and Biological Resources, Vietnam; **KIZ** = Kunming Institute of Zoology, the Chinese Academy of Science, China; **LSUHC** = La Sierra University Herpetological Collection, USA; **NCBS** = National Centre for Biological Sciences, Karnataka, India; **NHMUK** (formerly BMNH) = Natural History Museum, London, UK; **NHMW** = Naturhistorisches Museum Wien, Austria; **VNMN** = Vietnam National Museum of Nature, Hanoi, Vietnam; **SMF** = Natur-Museum und Forschungs-Institut Senckenberg, Frankfurt-am-Main, Germany; **ZFMK** = Zoologisches Forschungsmuseum Alexander Koenig, Bonn, Germany; **ZMH** = Zoologisches Museum Hamburg [formerly Zoologisches Institut und Museum], Universität Hamburg, Hamburg, Germany.

Comparative material examined

Trimeresurus stejnegeri (32 specimens). China. CIB DL2019092504, CIB DL2018090201, CIB DL2019040401, "Wuyi Mountain, Fujian". NHMUK 1940.3.19.21 "Fuzhou, Fujian". NHMUK 1899.4.24.61 "Guadun, Fujian". MH 010 "Minhou, Fujian". ZMH R07998 "Fujian". SMF 21223 "Hainan". FMNH 7134 "Anwei". NHMW 23913:1 "Daolin, Hunan". MH 002 "Sichuan". ZMH R07984 "Morisson Mountain, Taiwan". ZMH R07985–6, "Pingtung, Taiwan". NHMW 23906:2–6, "Tsu-Shari, Taiwan". NHMW 23907:1–4, "Jiayi, Taiwan". ZMH R07982 "Taiwan". ZMH R07983 "Candidius Sea, Taiwan". NHMW 23906:1, NHMW 23906:7, "Tsu-Shari, Taiwan". NHMW 23907:5–7, "China". Vietnam. ZFMK 92793 "Chu Yang Sin National Park, Dak Lak". NHMW 23912:3 "Vietnam".

Trimeresurus yunnanensis (6 specimens). China. FMNH 7064–5 (***Paratypes***), CIB DL30, CIB 2020090801, GXNU2024071032, NHMUK 1907.5.4.5, "Tengchong, Yunnan".

Trimeresurus gumprechti (7 specimens). Myanmar. CAS 241182 "Moenyin town, Kachin State". NHMW 23913:4 "Myanmar". Vietnam. IEBR 3918 HB.2014.31 "Hang Kia-Pa co/Hoa Binh". ZFMK 92790–1 "Ninh Thuan, phuc Bonh". Thailand. ZFMK 70444, ZFMK 78730, "Phu Luang".

Trimeresurus medoensis (6 specimens). China. CIB 2015101601–2, "Motuo, Xizang". Myanmar. NHMUK 1936.7.4.43, NHMUK 1940.6.5.73, "Nam Ti Valley, Upper Burma". CAS 221528, NHMUK 1940.6.5.73, "Kachin state".

Trimeresurus vogeli (12 specimens). Vietnam. ZMH R09625–6, "Saigon". ZFMK 86455–6, "Phong Nha Ke Bang NP". ZFMK 91074–5, "Lam Dong, Lac Duong, Bi Doup Mts, Nai Ba Forest". ZFMK 94923, ZFMK 92793–

5, "Dak Lak, Chu Yang Sin NP". ZFMK 94275 "Quang Ngai". Thailand. NHMUK 1937.2.1.38 "Hup Bon, Si Racha, Chonburi".

Trimeresurus truongsonensis (1 specimen). Vietnam. VNMN.3020 "Quang Binh".

Trimeresurus mayaae (6 specimens). Myanmar. CAS 234873, CAS 235959, "Chin State". NHMUK 1853.8.13.14, NHMUK 1874.4.29.882, "Himalaya". NHMUK 1937.3.1.19 "Putao, Kachin State". India. NHMUK 1907.12.16.27 "Shillong, Khasi Hills, Meghalaya".

Trimeresurus sp. nov. (11 specimens). China. CIB DL R353, "Cikai Town, Gongshan County, Yunnan". CIB DL10, CIB DL19, CIB DL R364, CIB DL R375, CIB DL R380, CIB DL-03-622, GXNU2024061101, "Gongshan County, Yunnan". CIB DL R362, CIB DL R363, CIB DL R365, "Bingzhongluo Town, Gongshan County, Yunnan".

Molecular analysis

Genomic DNA was isolated from the muscle or liver tissues using the TIANamp Marine Animals DNA Kit (TIANGEN Biotech). All samples were sequenced for four mitochondrial genes: cytochrome *b* (cyt *b*), NADH dehydrogenase subunit 4 (ND4), 12S ribosomal RNA gene (12S rRNA) and 16S ribosomal RNA gene (16S rRNA). The primers used for cyt *b* were Gludg (5'-AACCACCGTTGTACATCAACT-3') and H16064 (5'-CTTTGGTTTACAAGAACAATGCTTTA-3') following Palumbi (1996) and Simon et al. (1994), the primers used for ND4 were NADH4 (5'-CACCTATGACTACCAAAAGCTCATGTAGAAGC-3') and H12763V (5'-TTCTATCACTTGGATTTGCACCA-3') following Arevalo et al. (1994), the primers used for 12S rRNA were L1091 (5'-AAACTGGGATTAGATACCCCACTAT-3') and H1557 (5'-GTACACTTACCTTGTTACGACTT-3') following Knight and Mindell (1993), the primers used for 16S rRNA were 16SP7 (5'-CGCCTGTTTACCAAAAACAT-3') and 16SP8 (5'-CCGGTCTGAACTCAGATCACGT-3') following Simon et al. (1994). PCR amplifications were performed in a 25 µl reaction volume with the following cycling conditions: an initial denaturation step at 95 °C for 2 min; 35 cycles of denaturing at 94 °C for 40 s, annealing temperature at 48 °C (for cyt *b*) / 56 °C (for ND4) / 52 °C (for 12S rRNA) / 54 °C (for 16S rRNA) for 25 s and extending at 72 °C for for 15 s, and a final extending step of 72 °C for 2 min. Then, we selected the successful targeted PCR products, and sent them to Beijing TsingKE Biotech Co., Ltd. (Chengdu, China) and Sangon Biotechnologies Co., Ltd. (Shanghai, China) for PCR purification, cycle sequencing and sequencing. The sequencing primers and amplification primers are identical. Homologous DNA sequences of related species were downloaded from GenBank and incorporated into further phylogenetic analyses (Suppl. material 1).

Sequences were assembled and aligned using MEGA 11.0 (Kumar et al. 2018), evaluated and manually corrected if necessary. The sequence data were analyzed using Maximum likelihood (ML) implemented in RAxML v8.2.4 (Stamatakis 2014), and Bayesian Inference (BI) in MrBayes 3.2 (Ronquist et al. 2012). The best-fit model was obtained by the Bayesian inference criteria (BIC) computed with PartitionFinder 2.1.1 (Lanfear et al. 2017). The ML and BI analyses were conducted using RAxML v8.2.4 and MrBayes 3.2 with the same models: GTR+I+G was the best-fit for 12S rRNA, 16S rRNA, and the first codon position of cyt *b* and ND4, HKY+I+G for the second codon position of cyt *b* and ND4, and GTR+G for the third codon position of cyt *b* and ND4. Bootstrap support for ML analysis was assessed using 1000 replicates of nonparametric bootstrap resampling (Felsenstein 1985). For BI analysis, two independent runs with four Markov Chains Monte Carlo chains were performed for 20 million generations and sampled every 1000th generation. *Protobothrops elegans* and *Azemiops feae* were selected as outgroups (Malhotra and Thorpe 2004a; Chen et al. 2020). Uncorrected pairwise p-distances (% sequence divergence) based on cyt *b* were calculated in MEGA 11.0 (Kumar et al. 2018).

Results

Phylogenetic analysis

The Maximum likelihood (ML) and Bayesian inference (BI) phylogenetic trees were constructed based on concatenated DNA sequences of the mitochondrial cyt *b* (1098 bp), ND4 (693 bp), 12S rRNA (1065 bp) and 16S rRNA (528 bp) genes with a total length of 3384 bp, and contained a total of 60 taxa of *Trimeresurus*. The ML and BI analyses recovered trees with very similar topologies, so we only present the Bayesian phylogenetic tree, but it included both the ML bootstraps and Bayesian posterior probabilities (Fig. 1). Phylogenetically, the specimens from Tengchong, Yunnan Province (GXNU 2024071032, DL2020090801, DL30 and GXNU2025010203, from the type locality of *T. yunnanensis* Schmidt, 1925) form a clearly consistent lineage with samples from Loei, Thailand (AM A164, from the type locality of *T. gumprechti* David et al., 2002) (Fig. 1, BPP 1.00/BS 100). The uncorrected pairwise distances between *T. yunnanensis* (Serial No. 15–20) and samples originally identified as *T. gumprechti* (Serial No. 21–30) varies from 0% to 1.6% in mitochondrial cyt *b* divergence, which is obviously lower than the intra-species level of some other species (e.g. the cyt *b* gene divergence was 4.7% in *T. vogeli* and ranged from 0.3% to 3.5% in *T. popeiorum*). Therefore, we considered *T. gumprechti* David et al., 2002 as a subjective junior synonym of *T. yunnanensis* Schmidt, 1925.

Additionally, the phylogenetic tree indicates that the specimens collected from Gongshan County, Yunnan province represent a highly divergent lineage (Fig. 1, BPP 1.00/BS 100), with mitochondrial cyt *b* divergence 0.052–0.156 from all previously known species (Suppl. material 2). This

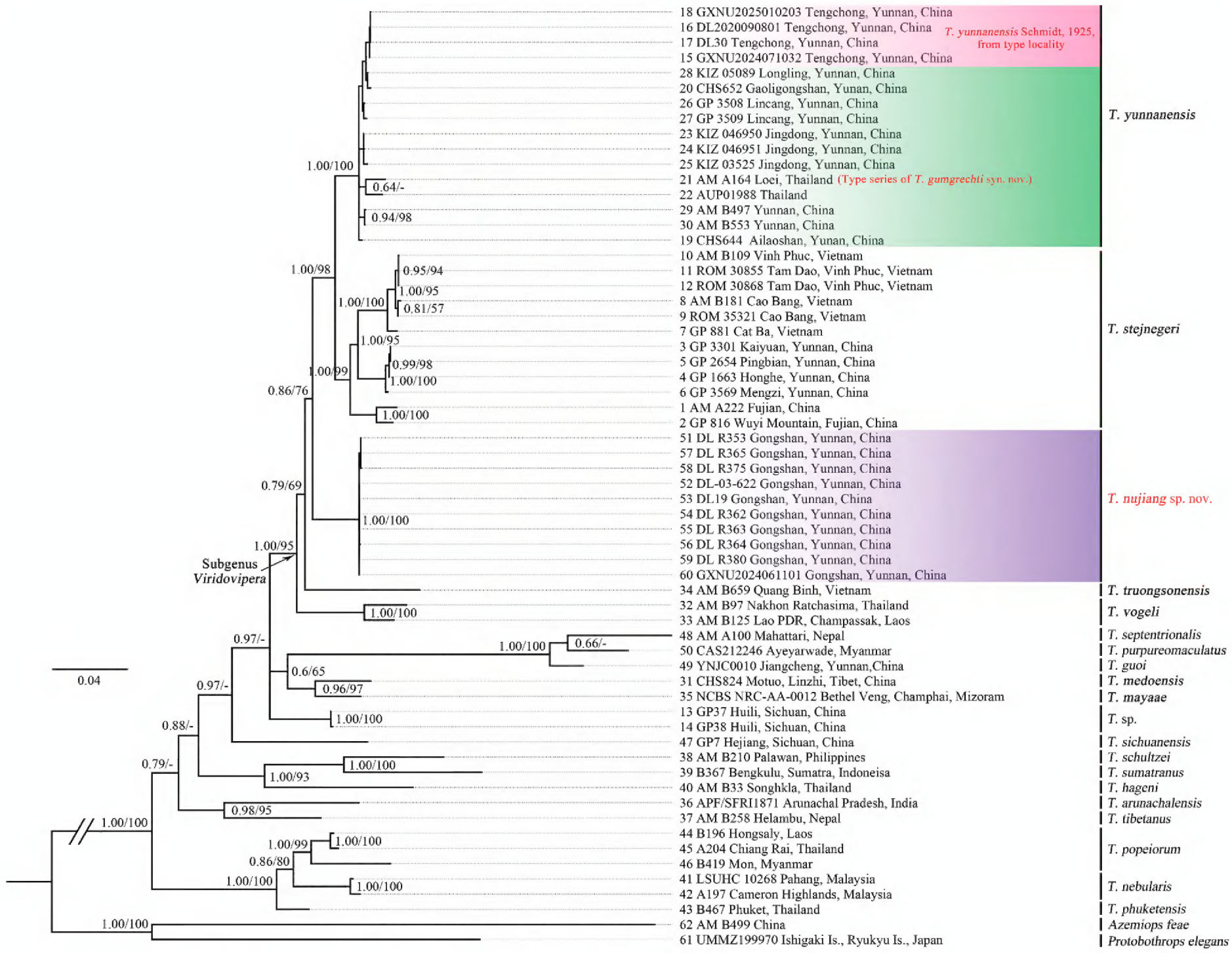

Figure 1. Phylogenetic tree of the genus *Trimeresurus* inferred by Bayesian analyses (BI) derived from concatenated mitochondrial gene alignment for cyt *b*, ND4, 12S rRNA and 16S rRNA. Both Bayesian posterior probabilities (BPP > 50, retained) and bootstrap supports (BS > 50, retained) are indicated on each of the corresponding nodes.

divergence is clearly among inter-species level since the uncorrected *p*-distance are 0.038–0.044 between *T. phuketensis* and *T. popeiorum* and 0.044–0.047 between *T. phuketensis* and *T. nebularis*. It was found to be the sister taxon of *T. stejnegeri* and *T. yunnanensis*. Together, these taxa formed a genetically distinct lineage and was clustered into the same clade with *T. truongsonensis*, *T. vogeli*, *T. medoensis*, *T. mayaae*, which all belong to subgenus *Viridovipera*.

Morphological results

The presence of 19 mid-body dorsal scale rows serves as a key diagnostic character for *T. yunnanensis* (Schmidt, 1925). Guo et al. (2009) further emphasized the diagnostic significance of dorsal scale row reduction in *T. yunnanensis*, demonstrating that the transition point from 21 to 19 rows occurs significantly anterior to that in closely related congeners. In all examined specimens (except BMNH 53.8.12.14 from Sikkim, India), this transition is positioned anterior to the 20th ventral scale, with no significant sexual dimorphism observed in this character. Based on the analysis and comparison of morphological traits recorded in the original description, examination of the type specimens and literature, we found that the four *Trimeresurus* specimens (GXNU 2024071032, DL2020090801, DL30 and GXNU2025010203) collected in Tengchong County, Yunnan Province in this study were highly similar to the type series of *T. yunnanensis*. This congruence is particularly evident in a critical diagnostic character: the reduction of dorsal scale rows from 21 to 19 occurs consistently anterior to the 20th ventral scale. Therefore, we identified the four specimens from Tengchong County, Yunnan Province as *T. yunnanensis*.

Morphological results showed that *Trimeresurus* specimens from Loei, Thailand (type series of *T. gumprechti* David et al., 2002 syn. nov.) match the original description of *T. yunnanensis* Schmidt, 1925 and the morphological characters of the topotype (Table 1, Fig. 2). They have the following common features: similar coloration of dorsal, venter, eye, postocular stripe and ventrolateral stripe; overlapping number of ventral scales (156–161 vs 155–170 in females; 151–164 vs 158–168 in males) and subcaudal scales (56–60 vs 53–64 in females; 62–67 vs 59–71 in males); overlapping dorsal scales at mid-body (19 vs 19/21). Besides, molecular analyses demonstrate

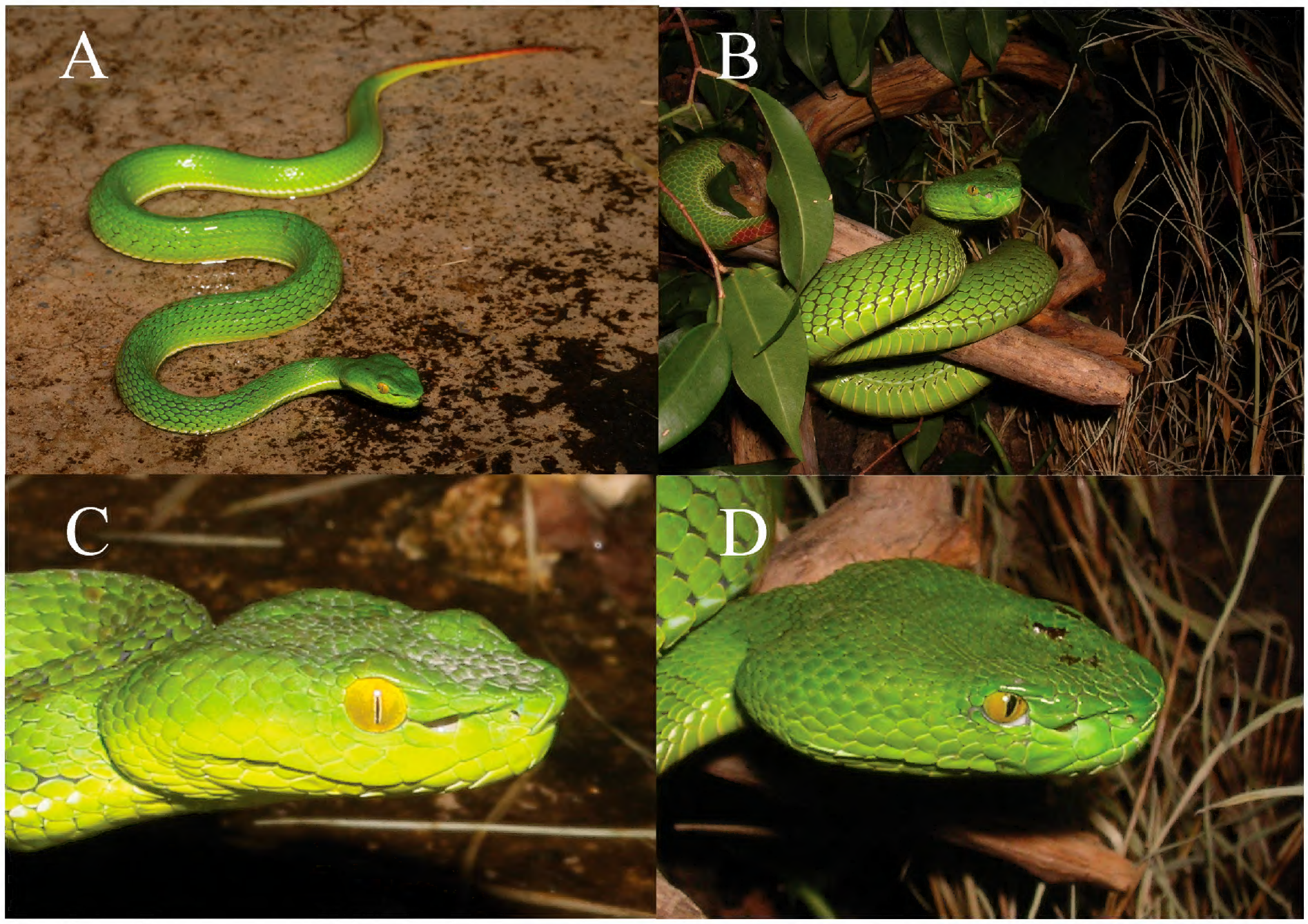

Figure 2. Comparison of coloration between *T. yunnanensis* and "*T. gumprechti*" in females. **A, C.** *T. yunnanensis*, collected from the type locality Tengchong, Yunnan Province; **B, D.** "*T. gumprechti*", collected from Loei Province, Thailand. **A, C.** Photos by Ze-Ning Chen; **B, D.** Photos by Gernot Vogel.

that the population of *T. gumprechti* syn. nov. and the population of *T. yunnanensis* from Tengchong, Yunnan Province were clustered on the same evolutionary branch. Therefore, we regard *T. gumprechti* as a subjective junior synonym of *T. yunnanensis*.

Taxonomy

***Trimeresurus nujiang* sp. nov.**

https://zoobank.org/3DB285C5-37EE-40A2-B832-F16CBDBEA16E

Type material. ***Holotype*** • CIB DL R353, an adult male from Cikai Town, Gongshan County, Nujiang Lisu Autonomous Prefecture, Yunnan Province, China (27°46'1.32"N, 98°40'50.78"E; altitude ca. 1537 m a.s.l); collected by Li Ding on 3 September 2020 (Figs 3, 4).

***Paratypes* (*N* = 10)** • CIB DL10 (male), CIB DL19 (male), CIB DL R364 (male), CIB DL R375 (male), CIB DL R380 (male), CIB DL-03-622 (female) and GXNU2024061101 (female) are around the site where the holotype was found. CIB DL R362 (female), CIB DL R363 (female) and CIB DL R365 (female) collected in Bingzhongluo Town, Gongshan County, Yunnan on 2 September 2020. Ten specimens collected at elevations between 1495–1699 m a.s.l. by Li Ding. Detailed information is presented in Table 2.

Etymology. The specific name "*nujiang*" refers to the location of type specimens, the area around the Nujiang River. As common name we suggest "Nujiang green pit-viper" in English and "Nù Jiāng Zhú Yè Qīng (怒江竹叶青)" in Chinese.

Diagnosis. A species of the genus *Trimeresurus* has a combination of the following characters: (1) Dorsal body olive drab or grass green, without bands or markings; interstitial skin greyish-black; ventral body yellow green. (2) Tail mostly reddish brown with dark brown tail end. (3) Dorsum of the head has the same color as the body, the upper labials are light green. (4) Moderate body size, with the maximum total length exceeding 804 mm. (5) White (above) and dark red (below) ventrolateral stripe present on the first row of dorsal scales, and the ventrolateral stripe continuous on the tail in males; faint white ventrolateral stripe in females. (6) Postocular streak absent in both sexes. (7) Iris golden-yellow in both sexes in life. (8) First supralabial completely separated from nasal scale. (9) Head scales not keeled; dorsal scale row 19 (rarely 21 or 22)–19–15 (rarely 13) (*N* = 11), feebly keeled except the outermost rows. (10) Internasals not in contact, most usually separated by 1–2 scales. (11) Supraoculars

Table 1. Main morphological characters of *T. yunnanensis* (including the specimens previously recognized as *T. gumprechti*). Abbreviations are noted in the materials and methods. "**" indicates hototype, "*" indicates paratype, "–" indicates missing data.

Sepecies	Collection number	Locality	Sex	DSR	TL (mm)	SVL (mm)	TaL (mm)	TaL/TL	Pre-VEN	VEN	SC	SL	IL	Cep	Reference
T. yunnanensis (*N* = 13)	AMNH 21058**	Tengchong, Yunnan, China	M	21-19-15	716	571	145	0.203	–	155	66	9/9	10/11	8	Guo et al. 2009
	FMNH 7065*	Tengchong, Yunnan, China	M	19-19-15	–	581	–	–	2	151	–	9/9	11/11	–	This study
	CIB DL30	Tengchong, Yunnan, China	M	21-19-15	661	541	120	0.182	3	158	63	9/9	–/11	7	This study
	74II0223	Tengchong, Yunnan, China	M	19-19-15	725	585	140	0.193	–	164	67	10	12	10	Yang et al. 2008
	74II0226	Tengchong, Yunnan, China	M	19-19-15	740	590	150	0.203	–	162	67	10/9	12/11	9	Yang et al. 2008
	74II0247	Tengchong, Yunnan, China	M	19-19-15	744	602	142	0.191	–	159	62	9	13/12	10	Yang et al. 2008
	FMNH 7064*	Tengchong, Yunnan, China	F	19-19-15	485	410	75	0.155	2	158	56	9/10	12/11	–	This study
	NHMUK 1907.5.4.5	Tengchong, Yunnan, China	F	19-19-15	639	535	104	0.163	1	158	57	10/10	12/13	–	This study
	CIB 2020090801	Tengchong, Yunnan, China	F	21-19-15	650	546	104	0.160	0	156	57	10/10	11/12	9	This study
	GXNU2024071032	Tengchong, Yunnan, China	F	19-19-15	470	397	73	0.155	1	161	56	10/9	11/11	9	This study
	74II0234	Tengchong, Yunnan, China	F	19-19-15	775	645	130	0.168	–	158	57	11	12	10	Yang et al. 2008
	74II0235	Tengchong, Yunnan, China	F	19-19-15	820	675	145	0.177	–	156	60	9/10	11/13	10	Yang et al. 2008
	74II0246	Tengchong, Yunnan, China	F	19-19-15	967	804	163	0.169	–	159	57	10/9	11/10	10	Yang et al. 2008
T. gumprechti syn. nov. (*N* = 19)	MNHN 1999.9072	Loei, Thailand	M	25-21-15	726	592	134	0.185	1	168	61	10/10	13/12	12	David et al. 2002
	MNHN 1999.9073	Loei, Thailand	M	–21-15	426	357	69	0.162	0	167	59	11/11	–	12	David et al. 2002
	RFI 1345	Phitsanulok, Thailand	M	–21-15	670	552	118	0.176	0	164	71	11/10	–	10	David et al. 2002
	ZFMK 70444	Phu Luang, Thailand	M	21-21-15	864	700	164	0.190	2	166	64	10/10	13/12	–	David et al. 2002
	PSUAA 0047	–	M	–21-15	767	608	159	0.207	0	163	71	9/10	–	12	David et al. 2002
	NMW 23913:4	Myanmar	M	21-21-15	514	416	98	0.191	1	162	71	10/10	12/13	–	This study
	IEBR 3918 HB.2014.31	Hang Kia-Pa co/Hoa Binh, Vietnam	M	23-21-15	542	442	100	0.185	–	158	70	10/10	12/13	–	This study

Sepecies	Collection number	Locality	Sex	DSR	TL (mm)	SVL (mm)	TaL (mm)	TaL/TL	Pre-VEN	VEN	SC	SL	IL	Cep	Reference
T. gumprechti syn. nov. (*N* = 19)	75II0177	Jingdong, Yunnan, China	M	19-19-15	622	506	116	0.186	–	164	69	10/11	12	10	Yang et.al. 2008
	CIB 75II0179	Jingdong, Yunnan, China	M	21-21-15	–	–	–	–	–	163	68	10	12	–	Zhao et al. 1998
	CIB 75II0207	Jingdong, Yunnan, China	M	21-21-15	–	–	–	–	–	162	70	10	12/14	10	Zhao et al. 1998
	CIB 581733	Jingdong, Yunnan, China	M	21-21-15	–	–	–	–	–	160	65	9	12/11	10	Zhao et al. 1998
	ZFMK 75797	Loei, Thailand	F	–21-15	777	654	123	0.158	0	170	54	11/11	–	11	David et al. 2002
	ZFMK 68524	Phu Luang, Thailand	F	–	1233	1047	186	0.151	–	–	–	–	–	–	David et al. 2002
	ZFMK 78730	Phu Luang, Thailand	F	22-21-15	1136	953	183	0.161	1	166	60	10/10	14/13	–	This study
	CAS 241182	Myanmar	F	21-21-15	799	670	129	0.161	4	170	62	11/11	13/13	–	This study
	ZFMK 92791	Ninh Thuan, phuc Bonh, Vietnam	F	23-21-15	221	184	37	0.167	1	158	53	10/9	13/13	–	This study
	ZFMK 92790	Ninh Thuan, phuc Bonh, Vietnam	F	21-21-15	1012	843	169	0.167	1	166	64	11/11	13/15	–	This study
	CIB JD20230725009	Huangcaoling, Jingdong County, Yunnan, China	F	21-21-15	290	242	48	0.166	3	155	54	11/11	11/11	11	This study
	CIB 75II0183	Jingdong, Yunnan, China	F	21-21-15	–	–	–	–	–	160	56	10	11	10	Zhao et al. 1998

large but elongate, separated by 10–11 smooth cephalic scales. (12) Ventral scales 164–173 in males (N = 6), 165–168 in females (N = 5). (13) Subcaudal scales 59–68 in males (N = 4), 57–60 in females (N = 5). (14) Total number of VEN+SC 226–241 in males (N = 4), 222–226 in females (N = 5). (15) Tail relatively short, and tail to total length ratio (TaL/TL) 0.147–0.163 in males (N = 4), 0.144–0.152 in females (N = 5). (16) Hemipenes short and spinose, bilobed at 6th/7th plate when unextruded, tips reaching SC 10, sulcus spermaticus shallow, visible, divides at the base of the organ.

Description of holotype male DL R353. (Figs 3, 4).

Morphology. Body cylindrical, long and thin, SVL 694 mm; TaL 110+ mm, the tail a bit missing; TL 804+ mm, ratio of tail length to total length (TaL/TL) over 13.7%. Head triangular, elongate, clearly distinct from the neck, head length 35.2 mm (HL/SVL 0.051); head width 22.6 mm (HW/HL 0.642). Distance between tip of snout and anterior border of eye 11.1 mm on both sides. Eyes large, eye diameter 4.4 mm (ED/HL 0.125); pupil vertically elliptic.

Body scalation. Dorsal scales in 21–19–13 rows; dorsal scales rhomboid, feebly keeled except the first row of scales, which are smooth; 169 ventral scales (plus 1 preventrals); 41+/42+ subcaudals, paired; anal shield single and entire.

Head scalation. Rostral slightly visible when viewed from above, subtriangular; a large pair of enlarged and subrectangular internasals bordered by one scale; nostril completely enclosed in nasal scale; nasal scale complete, completely separated from 1st supralabial, with only a trace of a suture, sub-pentagonal; three elongated preoculars on each side of the head, two lower preoculars and 2nd supralabial encompass the loreal pit; one elongate and narrow supraocular; one long, thin, crescent-like subocular scale; 2nd supralabials completely contact the anterior margin of the pit; two small scales on the left side and one small scale on the right side between the nasal and the foveal; 10 small and irregular cephalic scales between the supraoculars; temporal and occipital scales feebly keeled. 9/9 supralabials; 1st supralabial triangular, small; 2nd as high as the 1st supralabial, nearly of the same width throughout; 3rd supralabial largest, wider than high, and in contact with the subocular; 4th and 5th supralabials separated from the subocular by a single row of smooth scales; 6th supralabials separated from subocular by 2/2 scales. 12/12 infralabials; the first pair of infralabials are in contact with each other behind the mental; the first three pairs of infralabials are in contact with the anterior chin shields.

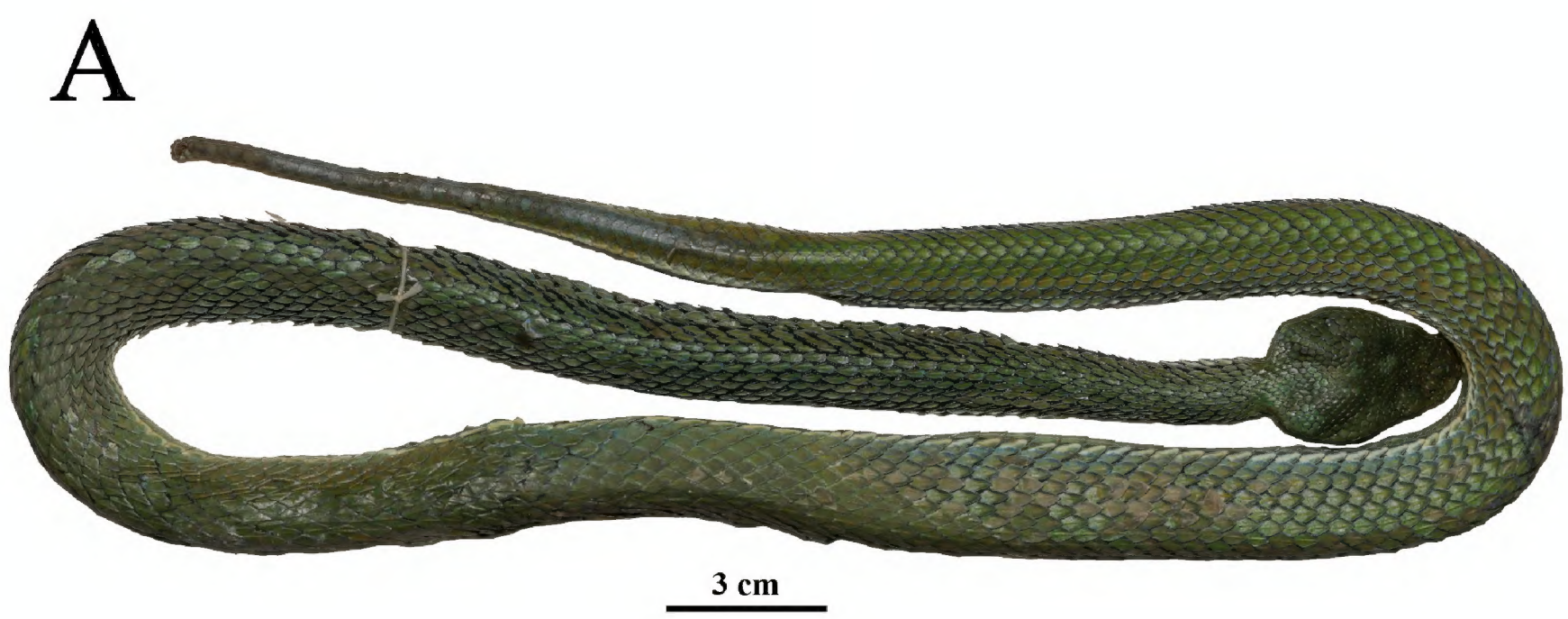

Figure 3. Holotype of *Trimeresurus nujiang* sp. nov. (male, CIB DL R353): **A.** Dorsal view; **B.** Ventral view.

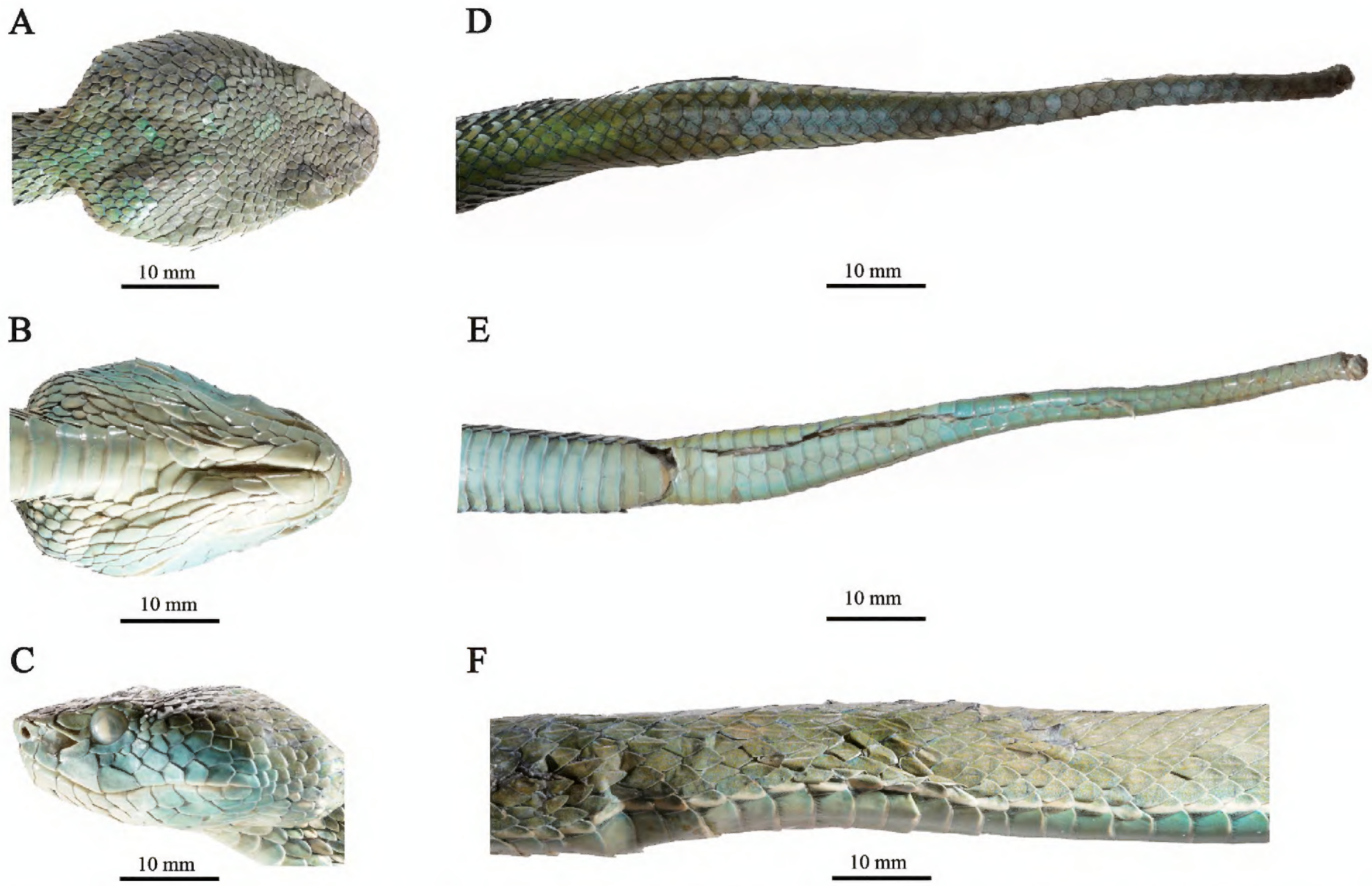

Figure 4. Holotype of *Trimeresurus nujiang* sp. nov. (male, CIB DLR353): **A.** Dorsal head; **B.** Ventral head; **C.** Left head; **D.** Dorsal views of the tail; **E.** Ventral views of the tail; **F.** Dorsolateral view of body.

Coloration in preservation (Figs 3, 4). Description based on holotype DL R353 fixed in formalin and later stored in 75% ethanol for approximately three years. Dorsal head and body olive drab, ventral color faded to whitish green. Lateral head olive above lower margin of eye, upper labials light green with bluish tint. The ventral surfaces of the head are creamy white with a bluish tint. Ventral surface of tail whitish green anteriorly, becoming paler bluish-green at the middle and end of tail. Ventrolateral stripe present, with white (above) and dark brown (below) on first dorsal scale rows.

Coloration in life (Fig. 5). Dorsal body generally olive drab in males and grass green in females, with greyish-black interstitial skin. Lateral head jungle-green above lower margin of eyes, and light green below, without postocular stripes in both genders. Lateral body deep green above and gradually become light green below. A white (above) and dark red (below) ventrolateral stripe present in males, a thin and light white ventrolateral stripe present in females, which ventrolateral stripe present on each scale of the first dorsal scale. Venter uniform yellowish-green. Tail mostly reddish-brown, dark brown at the end of the tail. Iris golden-yellow in both males and females, pupils edged with lighter color.

Hemipenis. Description based on two specimens, namely the holotype DL R353 and paratype DL19. The hemipenis is relatively short, papilloma, reaching only 10th subcaudal, and bifurcates at 6th–7th subcaudal when unextruded. Sulcus spermaticus shallow, visible, divides at the base of the organ.

Intraspecific morphological variation. The ten paratypes agree with the description of the holotype in most aspects except for the following difference: (1) ventrolateral stripe always present, males have obvious white or bicolored stripes, while females have thin and light white stripes; (2) dorsal scales in 19 (rarely 21 or 22)–19–15 (rarely 13) rows; (3) ventral scales 164–173 in males (N = 6), while165–168 in females (N = 5); (4) subcaudal scales 59–68 in males (N = 4), while 57–60 in females (N = 5); (5) total number of VEN+SC 226–241 in males (N = 4), while 222–226 in females (N = 5). (6) TaL/TL 0.147–0.163 in males (N = 4), 0.144–0.152 in females (N = 5); supralabial scales vary between 9 or 10 (N = 11); (7) infralabial scales vary from 11 to 13 (N = 11); (8) cephalic scales vary from 10 to 11 (N = 11) (See details in Table 2).

Comparison. The new species is morphologically and phylogenetically classified in the subgenus *Viridovipera* (Malhotra and Thorpe 2004a; Guo et al. 2009). We here compare the new species with the six other species of the subgenus *Viridovipera* (*T. stejnegeri*, *T. yunnanensis*, *T. medoensis*, *T. vogeli*, *T. truongsonensis*, *T. mayaae*) and other species of *Trimeresurus* occurring in Yunnan Province of China (*T. albolabris*, *T. caudornatus*, *T. guoi*, *T. popeiorum*, *T. lanna*). The main features that distinguish the new species from those known members of the subgenus *Viridovipera* are summarised in Suppl. material 3.

Table 2. Measurements (to 0.1 mm) of *Trimeresurus nujiang* sp. nov. Missing data are denoted with "–".

No.	Taxa	Voucher	Status	Locality	Sex	DSR	Pre-VEN	VEN	SC	Cep	VEN+SC	SL	IL	SVL	TaL	TL	TaL/TL	HL	HW
1	*T. nujiang* sp. nov.	CIB DL R353	Holotype	Cikai Town, Gongshan County, Yunnan	M	21-19-13	1	169	41+/42+	10	–	9/9	11/12	694	110+	804+	–	35.2	22.6
2	*T. nujiang* sp. nov.	CIB DL10	Paratype	Gongshan County, Yunnan	M	21-19-15	1	172	59	10	231	10/10	11/11	314	54	368	0.147	17.6	12.1
3	*T. nujiang* sp. nov.	CIB DL19	Paratype	Gongshan County, Yunnan	M	19-19-15	2	173	68	11	241	9/9	11/11	435	82	517	0.159	20.8	15.0
4	*T. nujiang* sp. nov.	CIB DL R364	Paratype	Gongshan County, Yunnan	M	19-19-15	2	165	61	10	226	10/9	13/11	266	50	316	0.158	15.8	10.9
5	*T. nujiang* sp. nov.	CIB DL R375	Paratype	Gongshan County, Yunnan	M	19-19-15	2	169	49+	10	–	10/10	11/11	300	44+	344+	–	17.4	11.6
6	*T. nujiang* sp. nov.	CIB DL R380	Paratype	Gongshan County, Yunnan	M	19-19-15	2	164	63	10	227	9/9	12/12	307	60	367	0.163	16.7	11.7
7	*T. nujiang* sp. nov.	CIB DL-03-622	Paratype	Gongshan County, Yunnan	F	19-19-15	0	168	58	10	226	10/10	13/12	357	60	417	0.144	19.8	11.5
8	*T. nujiang* sp. nov.	GXNU2024061101	Paratype	Gongshan County, Yunnan	F	22-19-15	2	165	57	11	222	10/10	12/12	682	122	804	0.152	33.7	11.7
9	*T. nujiang* sp. nov.	CIB DL R362	Paratype	Bingzhongluo Town, Gongshan County, Yunnan	F	21-19-15	1	166	58	11	224	10/10	11/11	267	47	314	0.150	17.1	12.2
10	*T. nujiang* sp. nov.	CIB DL R363	Paratype	Bingzhongluo Town, Gongshan County, Yunnan	F	19-19-15	1	166	60	10	226	10/9	12/13	252	45	297	0.152	15.6	11.3
11	*T. nujiang* sp. nov.	CIB DL R365	Paratype	Bingzhongluo Town, Gongshan County, Yunnan	F	19-19-15	1	168	58	10	226	9/9	12/12	238	40	278	0.144	15.0	11.6

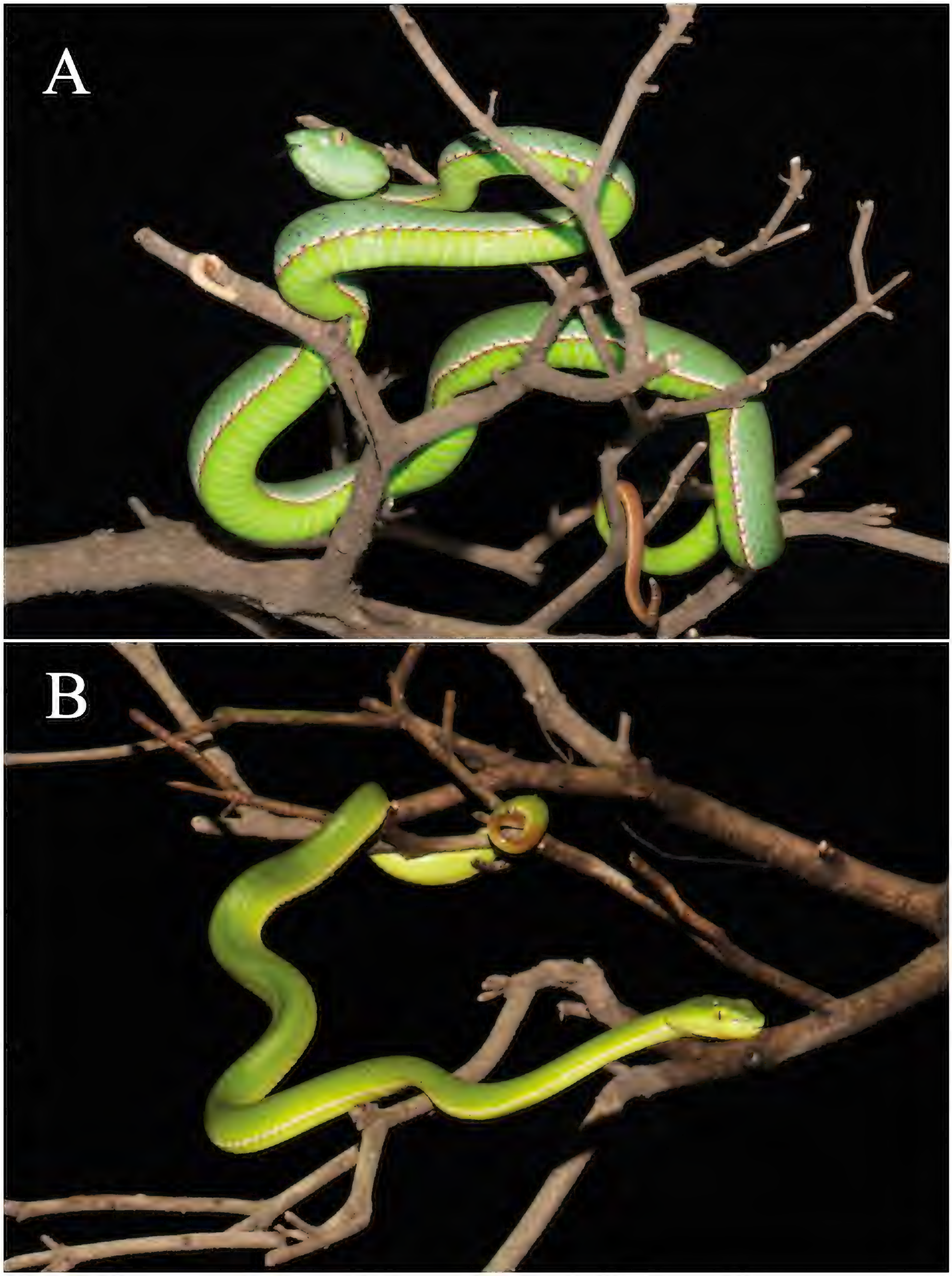

Figure 5. *Trimeresurus nujiang* sp. nov. in life: **A.** Holotype, male (DL R353); **B.** Paratype, female (CIB DL-03-622). Photographed by Li Ding.

Trimeresurus nujiang sp. nov. is distinguishable from *T. stejnegeri* by having: (1) Higher max SVL in both sexes (649 mm vs. 610 mm in males, 682 mm vs. 627 mm in females). (2) Lower ratio TaL/TL in both sexes (0.147–0.163 vs. 0.175–0.230 in males, 0.144–0.152 vs. 0.157–0.179 in females). (3) Slightly higher number of ventral scales in males (164–173 vs. 155–169). (4) Slightly lower number of subcaudal scales (59–68 vs. 61–77 in males, 57–60 vs. 57–68 in females). (5) MSR 19 vs. 21 in *T. stejnegeri*. (6) Postocular streak absent in both sexes vs. white (below) and red (above) or white in males and faint white or absent in females in *T. stejnegeri*. (7) Ventrolateral stripe present in males, dark red (below) and white (above) vs. red (below) and white (above) or white in *T. stejnegeri*. (8) Different eye color in both sexes (golden-yellow vs. bright red or amber (rarely yellow) in males, golden-yellow vs. yellow or amber in females).

Trimeresurus nujiang sp. nov. differs from *T. yunnanensis* by having: (1) More or less the same size vs. exhibiting sexual dimorphism in *T. yunnanensis*. (2) Lower ratio TaL/TL in both genders (0.147–0.163 vs. 0.162–0.207 in males, 0.144–0.152 vs. 0.151–0.177 in females). (3) Internasals are usually separated by 1–2 scales vs. internasals are always in contact or separated by one or two scales in *T. yunnanensis*. (4) MSR 19 vs. 19(45.16%) / 21(54.84%) in *T. yunnanensis*. (5) Postocular stripe always absent in both genders vs. absent or only thin and white present in females in *T. yunnanensis*. (6) Different color of ventrolateral stripe, dark red (below) and white (above) ventrolateral stripe in males vs. bright or deep red (below) and white (above) in *T. yunnanensis*; a faint white ventrolateral stripe present in females vs. white or absent in *T. yunnanensis*. (7) Different eye color in males, golden-yellow vs. deep red or sepia in *T. yunnanensis*.

Trimeresurus nujiang sp. nov. is distinguished from *T. medoensis* by having: (1) Higher max SVL in both genders (649 mm vs. 573 mm in males, 682 mm vs. 555 mm in females). (2) Lower ratio TaL/TL in both genders (0.147–0.163 vs. 0.165–0.208 in males, 0.144–0.152 vs. 0.163–0.185 in females). (3) Higher number of ventral scales in both genders (164–173 vs. 138–149 in males, 165–168 vs. 138–149 in females). (4) Higher number of subcaudal scales in males (59–68 vs. 53–63). (5) Higher total number of ventral scales and subcaudal scales in both genders (226–241 vs. 192–208 in males, 222–226 vs. 195–206 in females). (6) Cephalic scales 10–11 vs. 6–9 (rarely 10) in *T. medoensis*. (7) 19 dorsal rows at mid-body vs. 17 in *T. medoensis*. (8) Different color of ventrolateral stripe, dark red (below) and white (above) in males vs. red (below) and white (above) or white in *T. medoensis*; a white ventrolateral stripe present in females vs. a bright bicolored red (below) and white (above) in *T. medoensis*.

Trimeresurus nujiang sp. nov. differs from *T. vogeli* by having: (1) Lower ratio TaL/TL in both sexes (0.147–0.163 vs. 0.175–0.208 in males, 0.144–0.152 vs. 0.149–0.170 in females). (2) Slightly higher number of VEN in males (164–173 vs. 154–169), but slightly lower number of VEN in females (165–168 vs. 157–173). (3) Slightly lower number of SC in both sexes (59–68 vs. 62–74 in males, 57–60 vs. 59–65 in females). (4) Slightly higher total number of VEN+SC in males (226–241 vs. 221–239), while lower total number of VEN+SC in females (222–226 vs. 218–233). (5) Fewer cephalic scales, 10–11 vs. 11–14 in *T. vogeli*. (6) 19 dorsal scales at mid-body, slightly keeled vs. 21 (rarely 20) rows at mid-body, strongly keeled in *T. vogeli*. (7) Postocular streak absent in males vs. whitish yellow and rather faint or absent in *T. vogeli*. (8) Ventrolateral stripe present, dark red (below) and white (above) vs. red (below) and white (above) or white in *T. vogeli*. (9) Eye golden-yellow in both sexes vs. yellow or yellowish green in *T. vogeli*. (10) Tail mostly reddish brown in life vs. mostly green with only the tip or the last 20% of its length mottled with rusty brown in *T. vogeli*. (11) White vertebral spots absent in males vs. constantly present in *T. vogeli*.

Trimeresurus nujiang sp. nov. differs from *T. truongsonensis* by having: (1) Higher max SVL in both sexes (649 mm vs. 521 mm in males, 682 mm vs. 462 mm in females). (2) Lower ratio TaL/TL in both sexes (0.147–0.163 vs. 0.181–0.207 in males, 0.144–0.152 vs. 0.199 in females). (3) Lower total number of VEN+SC in both sexes (226–241 vs. 235–243 in males, 222–226 vs. 235 in females). (4) 19 dorsal scale rows at mid-body vs. 21 in *T. truongsonensis*. (5) Immaculate green dorsal colouration vs. dorsal colouration with blotches, spots, bands or crossbars in *T. truongsonensis*. (6) Dark red (below) and white (above) ventrolateral stripe in males vs. red-brown (below) and light greenish-blue (above) or white in *T. truongsonensis*. (7) Eye golden-yellow in males vs. greenish-yellow in *T. truongsonensis*.

Trimeresurus nujiang sp. nov. differs from *T. mayaae* by having: (1) Higher max SVL in both genders (649 mm vs. 610 mm in males, 682 mm vs. 590 mm in females). (2) Tail relatively smaller, ratio TaL/TL 0.147–0.163 vs. 0.165–0.234 in males, 0.144–0.152 vs. 0.165–0.169 in females. (3) More ventral scales in both genders (164–173 vs. 153–163 in males, 165–168 vs. 153 in females). (4) More subcaudal scales in females (57–60 vs. 54–55). (5) Higher total number of VEN+SC in both genders (226–241 vs. 211–231 in males, 222–226 vs. 207–208 in females). (6) 19 dorsal scales at mid-body, weakly keeled vs. 19 (15.80%) or 20 (7.69%) or 21 (69.23%), moderately keeled in *T. mayaae*. (7) Postocular stripe absent in males vs. conspicuous bicolored postocular stripe in *T. mayaae*. (8) Dark red (below) and white (above) ventrolateral stripe in males vs. vivid, wide bicolored ventrolateral stripe, deep red (below) and white (above) in *T. mayaae*. (9) Differences in eye color, eyes golden-yellow in both genders vs. rust in males and green in females in *T. mayaae*.

Trimeresurus nujiang sp. nov. is different from *T. albolabris*, *T. caudornatus*, *T. guoi* by having the first supralabial completely separate from nasal scale (vs. partially or completely fused to the nasal scale), scales in 19 longitudinal rows at mid-body (vs. 21 or rarely 19), and different structure of the hemipenes.

Trimeresurus nujiang sp. nov. is different from *T. popeiorum* by: (1) Different color of dorsal surfaces, olive drab or grass green vs. various shades of green, bluish-green or even turquoise blue in *T. popeiorum*. (2) Different color of ventrolateral stripe in both genders, dark red (below) and white (above) vs. bright and deep red (below) and white (above) in males; thin white vs. thin white or yellow in females. (3) No postocular streak in males vs. bicolored postocular streak present in *T. popeiorum*. (4) Eyes golden-yellow in both males and females vs. red or deep red in *T. popeiorum*. (5) MSR 19 vs. 21 in *T. popeiorum*. (6) Shorter hemipenes, short and spinose vs. long and no spines in *T. popeiorum*. (7) 10–11 cephalic scales between the supraoculars vs. 10–13 in *T. popeiorum*. (8) Tail relatively shorter, 0.147–0.162 vs. 0.18–0.21 in males, 0.140–0.152 vs. 0.14–0.19 in females.

Trimeresurus nujiang sp. nov. is different from *T. lanna* by: (1) Dorsal surfaces generally olive drab or grass green vs. deep green in *T. lanna*. (2) Postocular streak absent in both genders vs. white and thin ventrally, broad and bright red dorsally, covering two or three temporal scales in males and streak absent or only white in females. (3) Bicolored ventrolateral stripe in males, dark red below and white above vs. a wide, bright and deep red below, white above; a thin white ventrolateral stripe present in females vs. thin and pale yellow anteriorly, whitish posteriorly. (4) 19 dorsal scales rows at mid-body vs. 21 (93.3%) or rarely 20 (6.7%) in *T. lanna*. (5) Hemipenes short and spinose, reaching only 10th SC vs. long and forked without spines, reaching at least 25th SC.

Distribution and habitat. Currently, *Trimeresurus nujiang* sp. nov. is known only from the type locality in Gongshan County, Nujiang Lisu Autonomous Prefecture, Yunnan Province, China (Fig. 6). The collected individuals were encountered at night, perched on tree branches near the Grand Canyon of the Nujiang. It is currently known to be found in subtropical broad-leaved evergreen forests at elevations reaching approximately 1500–1700 m in Gongshan, Yunnan, China (Fig. 7). Gongshan County is located in the Nujiang Lisu Autonomous Prefecture in the

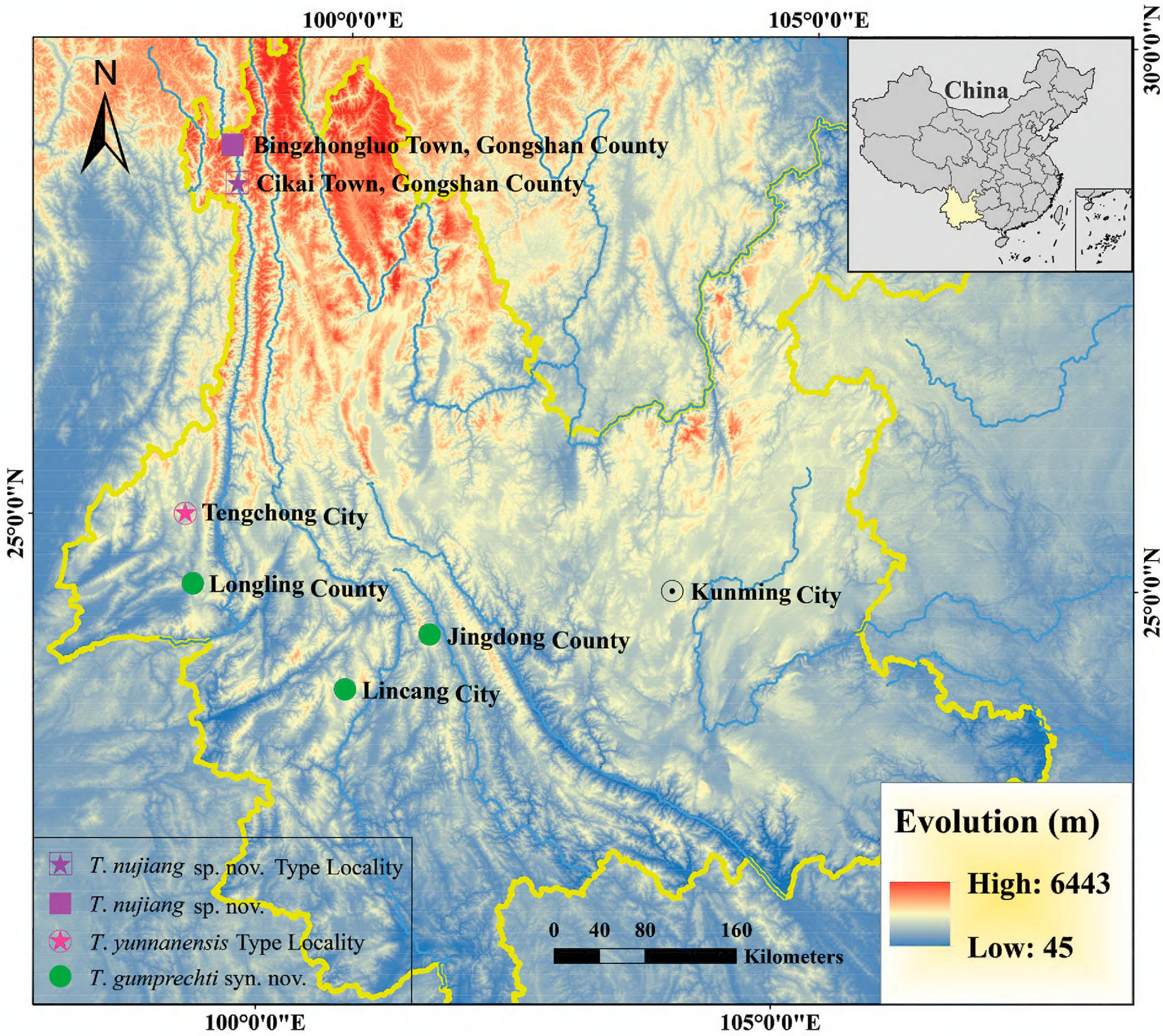

Figure 6. Distribution points of *T. nujiang* sp. nov. (Purple), *T. yunnanensis* (Pink) and *T. gumprechti* syn. nov. (Green) in Yunnan Province, China. The star patterns inside represent the type locality.

Figure 7. Habitat of *Trimeresurus nujiang* sp. nov. in the type locality of Gongshan County, Nujiang Lisu Autonomous Prefecture, Yunnan Province.

northwestern part of Yunnan Province, bordering Myanmar to the west. Nujiang River originates on the Tibetan Plateau and flows through the Nujiang Lisu Autonomous Prefecture in Yunnan Province, where it exits and flows into Myanmar. It is assumed that the new species may also be distributed in Myanmar.

Discussion

The pit viper snake subgenus *Viridovipera* Malhotra & Thorpe, 2004a, is a group of green arboreal vipers with 7 known species distributed throughout the South and Southeast. The species in this subgenus are predominantly green, with minimal discernible differences among them, thus posing challenges and uncertainties for classification. Among the currently known species in this subgenus, there are three species with similar morphological characteristics and close phylogenetic relationships, namely *T. stejnegeri*, *T. yunnanensis*, and *T. nujiang* sp. nov.. *T. stejnegeri* is the type species of the subgenus *Viridovipera*, which was originally described and named by Schmidt in 1925 based on a male holotype specimen from Shaowu City, Fujian Province. *Trimeresurus yunnanensis* Schmidt, 1925, a species of the subgenus *Viridovipera*, was initially discovered by R. C. Andrews and Edmund Heller in Tengyueh (Tengchong City), Yunnan Province on May 18th, 1917. Subsequently, *T. yunnanensis* was scientifically described in 1925 by Karl Patterson Schmidt at the American Museum of Natural History (Schmidt 1925). The original description of *T. yunnanensis* is relatively sparse with only a few brief lines at the time. It is closely allied to *T. stejnegeri* and can be diagnosed mainly on the basis of having only 19 scale rows at midbody vs 21 in *T. stejnegeri* (Schmidt, 1925), the character playing a crucial role in distinguishing it from its congeners. The four specimens (Serial No. 15–20), which were collected at the type locality of *T. yunnanensis* examined in this study, have 19 dorsal scale rows at midbody, matching the original description of *T. yunnanensis* Schmidt, 1925. The phylogenetic results demonstrate that the specimen from type locality of *T. gumprechti* David et al., 2002 syn. nov. (AM A164) form a strongly supported monophyletic group to the specimens from type locality of *T. yunnanensis* Schmidt, 1925 (GXNU 2024071032, DL2020090801, DL30 and GXNU2025010203) collected in this study. Malhotra and Thorpe (2004b) argued that "*T. gumprechti*" and *T. yunnanensis* might be conspecific based on the following evidence: "*T. gumprechti*" as determined by DNA analysis was present at the type locality of *T. yunnanensis*, and the female paratype of *T. yunnanensis* (the holotype had not been examined at that time) was morphologically similar to "*T. gumprechti*". Our molecular and morphological analyses support this hypothesis. Based on overlapping morphological characters and molecular data, we synonymized *T. gumprechti* David et al., 2002 with *T. yunnanensis* Schmidt, 1925.

T. nujiang sp. nov. is sister to *T. stejnegeri* and *T. yunnanensis*, and similar to *T. yunnanensis* in morphology. Although the number of the dorsal scale rows of *Trimeresurus* specimens collected from both Tengchong City and Gongshan County in Yunnan Province amounted to 19 rows, their molecular phylogenetic results show significant differences. Furthermore, after a long-term investigation, this new species was discovered near the Nujiang River, but it was not found in the south of Gongshan County in Yunnan Province and nearby regions of Tengchong City, Yunnan Province. Morphological characteristics, molecular phylogenetic trees, genetic distance analysis results, and field surveys all corroborate with each other, confirming that *T. nujiang* sp. nov. can be clearly distinguished from known species at the morphological and molecular levels, thereby supporting its classification as an independent species. Currently, the specimens we have collected mainly come from areas ranging from 1500 to 1700 metres above altitude. However, field surveys confirmed that this species occurs at elevations of 2000 m through observational records (without specimen collection). This suggests that the species' range may be broader, potentially extending to even higher altitudes. The discovery of *T. nujiang* sp. nov. adds to our growing knowledge of the diversity of Gongshan County, Yunnan Province. Although this region is located in a well-acknowledged biodiversity hotspot (Myers et al. 2000; Marchese 2015), the highly similar morphological characteristics of the genus result in difficulties distinguishing them in the wild. Despite comprehensive animal surveys conducted in recent years, certain areas in North-west Yunnan remain understudied.

It is expected that more reptile species will be discovered. It is likely that *T. nujiang* sp. nov. also occurs in Myanmar, as the type locality lies close to the China-Myanmar border. Several other *Trimeresurus* species

including *T. albolabris*, *T. stejnegeri*, *T. yunnanensis*, *T. popeiorum*, *T. guoi*, *T. lanna* occur both in Yunnan, China, and Myanmar. As most of the border area between China and Myanmar lies within the same zoogeographic region (Holt et al. 2013), it is likely that the diversity of the genus *Trimeresurus* in Myanmar may be underestimated, and more species may occur on both sides of the border. Therefore, it is necessary to conduct more field investigations, further apply molecular classification techniques to conduct comprehensive classification and analyses, and carry out international cooperation in order to better understand the species diversity of the genus *Trimeresurus* in the China-Myanmar border.

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Supplementary material 1

Details of DNA sequences and GenBank accession numbers in this study

Authors: Ya-Ting Liang, Li Ding, Gernot Vogel, Ze-Ning Chen, Zheng-Jun Wu

Data type: xlsx

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Link: https://doi.org/10.3897/zse.101.162424.suppl1

Supplementary material 2

Uncorrected p-distances based on cyt *b* gene for *Trimeresurus*

Authors: Ya-Ting Liang, Li Ding, Gernot Vogel, Ze-Ning Chen, Zheng-Jun Wu

Data type: xlsx

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Supplementary material 3

Comparison of morphological characteristics of *Trimeresurus nujiang* sp. nov. with those of the members of the subgenus *Viridovipera*

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Data type: xlsx

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